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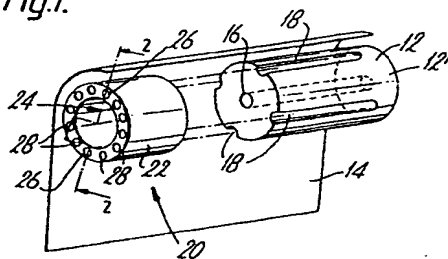
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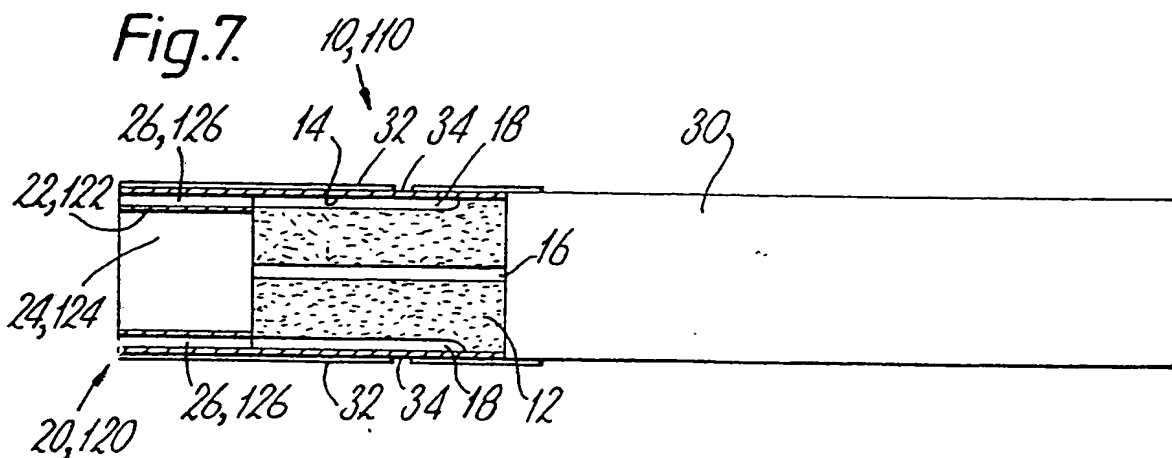
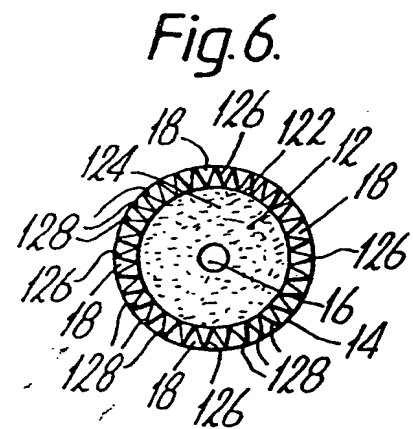
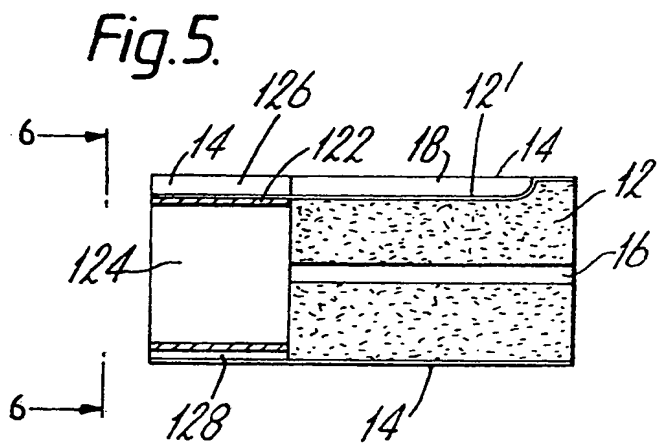
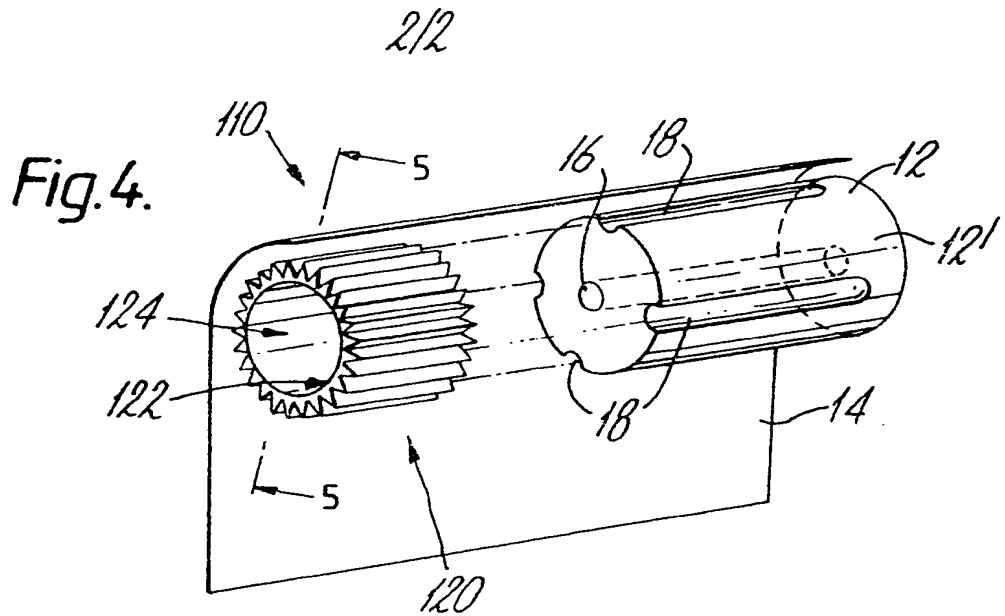
(54) Improved cigarette filter

(57) A filter for a cigarette includes a porous filter rod having a capillary smoke passageway extending coaxially therethrough and a hollow, generally cylindrical mouthpiece coaxially located with the filter rod at the mouth end of the filter rod. The filter rod is circumscribed by a non-porous wrapper, and the filter rod with the non-porous wrapper therearound is provided with grooves extending from the mouth end thereof a preselected distance longitudinally therealong. The mouthpiece is formed with air flow channels in flow communication with the grooves of the filter rod, and smoke flow channels in flow communication with that area of the filter rod mouth end between adjacent grooves of the filter rod. Tipping material circumscribes the filter rod and the mouthpiece, and is provided with flow-through openings therein in flow communication with the grooves.

Fig.1.



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SPECIFICATION

Improved cigarette filter

5 This invention relates to tobacco smoke filters for cigarettes. In one aspect it relates to a filter having a filter rod and coaxial mouthpiece with ventilating means in the filter rod. In even another respect the invention relates to a filter having a filter rod and
 10 coaxial mouthpiece for a cigarette having smoke directing means therein in combination with ventilating air means.

It is well known in the tobacco industry art to add filters to cigarettes wherein the filters are provided
 15 with ventilating means to bring ambient air into the filter to dilute the tobacco smoke stream. The dilution of the smoke stream reduces the quantity of smoke particulates as well as gas phase components which are delivered to the mouth of the smoker. A number of
 20 means have been proposed and are utilised for introducing ventilating air into a cigarette. For example, the wrapper for the tobacco in a cigarette can be made from a porous material which allows for introduction of air along the entire length of the
 25 cigarette where it mixes with smoke stream passing therethrough, thereby diluting the smoke in the stream. It is also known for the cigarette wrapper to be perforated at selected locations along the length of a cigarette to provide ports through which ventilating
 30 air enters. Even further, it is known in regard to filter tipped cigarettes to perforate the wrapper of the filter for dilution of the smoke stream. There have also been a number of suggestions for incorporating grooves within the filter plug in order to facilitate the addition
 35 of ventilating air into the smoke stream.

US Patent No. 3,596,663 relates to a tobacco smoke filter provided with a corrugated porous plug wrap surrounding a filter element which is circumscribed by a tipping paper having flow-through perforations
 40 therein whereby ventilating air enters directly into the filter element or progresses down the grooves to the smoker's mouth. Other patents which relate to cigarette filters having grooves circumscribing the filter element for the introduction of ventilating air into the filtering end of the filter cigarette include US
 45 Patents Nos. 3,577,995; 3,572,347; 3,490,461; 1,718,122; 3,788,330; 3,773,053; 3,752,165; 3,638,661; 3,608,561 and 3,910,288; West German Patent No. 2,302,677; and British Patents Nos. 1,414,745;
 50 1,360,612; and 1,360,611. The aforementioned British patents are directed to non-wrapped cellulose acetate filters. Furthermore, there are a number of patents directed to the incorporation of centrally disposed tubes in cigarette filters. These include, for example,
 55 US Patents Nos. 3,860,011; 4,037,524; 4,086,846; 4,022,221; 3,045,680; 3,621,851; 3,674,036; 4,109,666; and 4,256,122. Further, US Patent No. 4,380,241 relates to a non-filtering cigarette mouthpiece including a centrally disposed smoke flow tube.

60 The present invention advantageously provides a straight forward arrangement of a filter for a cigarette which in one form achieves normal cigarette pressure drop with low to high efficiency filters. The present

invention further provides a cigarette filter for lowering tar by ventilation as well as filtration. The present
 65 invention even further provides a filter ventilation system for a cigarette utilising grooves in the filter plug extending from tipping perforations in the tipping paper to the mouth end of the filter. The
 70 present invention also provides a grooved filter with a non-porous plug wrap. The present invention even also provides means for directing an unfiltered, undiluted smoke stream through a filter to the centre thereof and simultaneously therewith provides means
 75 for directing ventilating air along the outer surface thereof.

Various other features of the present invention will become obvious to those skilled in the art upon reading the disclosure set forth hereinafter.

80 More particularly, the present invention provides a filter for a cigarette comprising, a porous filter rod of cylindrical configuration; means defining a smoke flow capillary passageway formed concentrically with the longitudinal axis of the filter rod and extending
 85 longitudinally therethrough; a wrapper circumscribing the filter rod leaving flow-through opposed ends of the filter rod, the wrapper having a plurality of longitudinally extending grooves embedded into the filter rod, at least that portion of the wrapper defining
 90 each groove being impervious, the grooves being open ended at the mouth end of the filter rod and extending from the mouth end a distance less than the length of the filter rod; a hollow, generally cylindrical mouthpiece coaxially located with said filter rod at the
 95 mouth end of the filter rod, the hollow interior of the mouthpiece being open at both ends of the mouthpiece, the circumferential wall of the mouthpiece being formed with a plurality of air flow channels extending generally longitudinally of the mouthpiece
 100 from one end to the other end of the mouthpiece, the air flow channels being in flow communication with the open ends of the grooves at the mouth end of the filter rod, the circumferential wall of the mouthpiece being formed with a plurality of filtered smoke flow
 105 channels extending generally longitudinally of the mouthpiece from one end to the other end of the mouthpiece, the filtered smoke flow channels being in flow communication with that area of the filter rod mouth end between adjacent grooves of the filter rod,
 110 and the hollow interior of the mouthpiece being in flow communication with the smoke flow capillary passageway of the filter rod; and, tipping material extending longitudinally of and circumscribing the filter rod and mouthpiece, the tipping material including
 115 means for introducing ventilating air into the grooves of the filter rod, ventilating air being the only fluid flowing through the grooves and through the air flow channels in the mouthpiece when a cigarette having the filter is smoked.

120 In order that the present invention may be clearly understood and readily carried into effect, reference will now be made, by way of example, to the drawings hereof. It is to be understood that the descriptions of the examples of the present invention given hereinafter are not by way of limitation and various modifications within the scope of the present invention will

occur to those skilled in the art upon reading the disclosure set forth hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows an exploded, perspective view of a cigarette filter;

Figure 2 shows an axial cross-sectional view of the filter of Figure 1 as viewed in the direction of arrows 2-2 of the section line in Figure 1;

Figure 3 shows an end view of the filter of Figures 1 and 2 as viewed in the direction of arrows 3-3 in Figure 2;

Figure 4 shows an exploded, perspective view of another cigarette filter;

Figure 5 shows an axial cross-sectional view of the filter of Figure 4 as viewed in the direction of arrows 5-5 of the section line in Figure 4;

Figure 6 shows an end view of the filter of Figures 4 and 5 as viewed in the direction of arrows 6-6 in Figure 5; and

Figure 7 shows an axial cross-sectional view of the filter of Figures 1 or 4 attached to a wrapped tobacco column.

In Figures 1 and 2, a filter 10 of the present invention is shown. This filter 10 comprises a filter rod 12 made from fibrous or foamed materials for tobacco smoke which may be known in the art, cellulose acetate for example, circumscribed by a non-porous wrapper 12'. It is to be understood that the use of the term "non-porous wrapper", includes non-porous outer surfaces of foamed material which are integral with the filter element as well as non-porous wrapping material which is not integral with the filter element. A smoke flow capillary passageway 16 is formed concentrically with the longitudinal axis of the filter rod 10 and extends longitudinally from one end (tobacco end) to the other end (mouth end) of the filter rod 12. The smoke flow capillary passageway 16 can, for example, be formed during an extrusion process of formation of rod 12. The wall of the capillary passageway 16 can be either pervious or impervious. Furthermore, the filter rod 12 is provided with a plurality of grooves 18 extending longitudinally therealong from the mouth end of filter rod 12 a predetermined distance less than the entire length of the filter rod 12. The filter rods 12 are generally prepared by taking a standard filter rod of cellulose acetate or the like, wrapping the rod with a non-porous wrapping material, then subjecting the wrapped filter rod to a moulding or other treating means designed for putting appropriate grooves therein. One such method is known as a heat moulding technique, which is well known in the art.

With continued reference to Figures 1 and 2, and additional reference to Figure 3, the filter 10 also includes a generally cylindrical, hollow mouthpiece 20 coaxially located with the filter rod 12 at the filter rod mouth end. The mouthpiece 20 is formed by a circumferential wall 22 which defines the generally hollow interior 24. The hollow interior 24 is open at both ends of the mouthpiece 20, and has a smaller radius than the radial distance from the smoke flow capillary passageway 16 to the grooves 18 at the filter rod mouth end. The circumferential mouthpiece wall 22 is preferably fabricated of an impermeable material such as, for example, a plastic, and can be manufac-

tured by extrusion. The circumferential wall 22 is formed with a plurality of circumferentially spaced apart air flow channels 26 extending generally longitudinally of the mouthpiece and being open to ends of the mouthpiece. As shown, the air flow channels 26 are formed through the body of the circumferential wall 22. The air flow channels 26 are located in air flow communication with the grooves 18 of the filter rod 12. As illustrated, the number of air flow channels 26 is equal to the number of grooves 18 with each air flow channel 26 in flow communication with a different one of the grooves 18. However, it is contemplated that the number of air flow channels 26 can be greater than the number of grooves 18, and that more than one air flow channel 26 will, therefore, be in flow communication with each one of the grooves 18. In addition, the circumferential mouthpiece wall 22 is formed with a plurality of circumferentially spaced apart filtered smoke flow channels 28 extending generally longitudinally of the mouthpiece 20 and being open to both ends of the mouthpiece. As shown, the filtered smoke flow channels 28 are formed through the body of the circumferential wall 22. The filtered smoke flow channels 28 are located in smoke flow communication with that area of the filter rod mouth end between adjacent grooves 18 of the filter rod 12. As shown, each of the smoke flow channels 28 has substantially the same flow through area as each of the air flow channels 26. Further, the air flow channels 26 and smoke flow channels 28 are radially spaced from the longitudinal axis of the filter 10 by the same dimension. The hollow interior 24 of the mouthpiece 20 is in flow communication with the smoke flow capillary passageway 16 and with that portion of the filter rod 12 radially inwardly of the portion of the filter rod 12 in flow communication with the smoke flow channels 28 at the filter rod mouth end. Towards this end, the circumferential mouthpiece wall 22 is thicker than the depth of the outlet end of the grooves 18 at the filter rod mouth end.

With reference to Figures 4-6, in respect to a filter 110 there is shown another advantageous embodiment of the hollow, generally cylindrical mouthpiece of the present invention, denoted generally as the numeral 120. The mouthpiece 120 is formed by a circumferential wall 122 which defines the generally cylindrical hollow interior 124. The hollow interior 124 is open at both ends of the mouthpiece 120. The circumferential wall 122 is formed with a plurality of circumferentially spaced apart air flow channels 126 extending longitudinally of the mouthpiece and being open to both ends of the mouthpiece. As shown in Figures 4-6, the air flow channels 126 are defined by serrations formed in the outer peripheral surface of the circumferential wall 122. The circumferential mouthpiece wall 122 is also formed with a plurality of circumferentially spaced apart filtered smoke flow channels 128 extending generally longitudinally of the mouthpiece 120 and being open to both ends of the mouthpiece. As shown, the filtered smoke flow channels 128 are defined by serrations formed in the outer peripheral surface of the circumferential wall 122. The air flow channels 126 are in flow communication with the filter rod grooves 18, and the filtered smoke flow channels 128 are located in smoke flow

communication with that area of the filter rod mouth end between adjacent grooves 18 of the filter rod 12. Figures 4-6 illustrate the serrations defining the air flow channels 126 and the serrations defining the smoke flow channels 128 as being substantially identical in size and shape, and uniformly circumferentially spaced apart about the mouthpiece wall. That is, the outer peripheral surface of the circumferential mouthpiece wall 122 is formed with uniform

serrations therearound and extending longitudinally therealong. As with the mouthpiece 20 of Figures 1-3, the hollow interior 124 of the mouthpiece 120 is in flow communication with the smoke flow capillary passageway 16 and with that portion of the filter rod mouth end radially inwardly of the portion of filter rod in flow communication with the smoke flow channels 128 at the filter rod mouth end. This is accomplished by making the circumferential wall 122 of the mouthpiece thicker than the depth of the grooves 18 at the filter rod mouth end.

The mouthpiece 20, 120 is attached to the filter rod 12 by means of a porous wrapper 14. Toward this end, as can be seen in Figure 7, the wrapper 14 extends beyond the mouth end of the filter rod 12 and in circumferential overlaying relationship to the mouthpiece.

Figure 7 illustrates the filter 10, 110 attached to a wrapped tobacco column 30 and wrapped by tipping paper 32. The tipping paper 32 extends longitudinally of the filter 10 circumscribing the wrapper 14 holding the mouthpiece 20, 120 to the filter rod 12, and circumferentially overlaps a portion of the end of the tobacco column 30 thereby attaching the filter 10, 110 to the tobacco column. The tipping paper 32 is formed with a plurality of perforations 34 therein circumferentially surrounding filter rod 12 of the filter 10, 110 and disposed in alignment with the grooves 18 wherein ventilating air radially enters the grooves 18 through the perforations 34. It is realised that in the use of the term "tipping paper" this may include commercially available tipping paper in combination with an air permeable wrapper which is used in the assembly of the filter prior to attachment to a tobacco column. As shown in Figure 7, ventilating air enters through the tipping perforations 34 travelling down the grooves 18 and toward the smoker's mouth through the air flow channels 26, 126 of the mouthpiece 20, 120, respectively. The smoke flow capillary passageway 16 is disposed to concentrate the smoke in the central portion of the filter rod 12 for directing a stream of unfiltered, undiluted smoke into the hollow interior 24, 124 of the mouthpiece 20, 120, respectively, toward the mouth of the smoker. Concurrently, a portion of filtered smoke flows from the area of the filter rod 12 between adjacent grooves 18 and into the filtered smoke channels 22, 122 of the mouthpiece 20, 120, respectively, toward the smoker's mouth, while another portion of smoke flows from that area of the mouth end of the filter rod 12 encompassing the capillary passageway 16 into the hollow mouthpiece interior 24, 124 surrounding the stream of unfiltered smoke issuing from the capillary passageway 16 directed toward the smoker's mouth. The filtered smoke entering the smoke flow channels 28, 128 from the filter rod 12 is accelerated and enters the smoker's

mouth in streams adjacent the air streams entering the smoker's mouth from the air flow channels 26, 126. The filtered smoke entering the hollow interior 24, 124 of the mouthpiece from the filter rod 12 is generally evenly distributed about the unfiltered smoke stream entering the hollow interior 24, 124 from the smoke flow capillary 16 moving at a slower velocity than the stream of unfiltered smoke from the capillary passageway 16.

The foregoing detailed description is given primarily for clearness of understanding and no unnecessary limitations are to be understood therefrom for modifications will become obvious to those skilled in the art upon reading this disclosure and may be made without departing from the spirit of the invention and scope of the appended claims.

CLAIMS

1. A filter for a cigarette comprising, a porous filter rod of cylindrical configuration; means defining a smoke flow capillary passageway formed concentrically with the longitudinal axis of the filter rod and extending longitudinally therethrough; a wrapper circumscribing the filter rod leaving flow-through opposed ends of the filter rod, the wrapper having a plurality of longitudinally extending grooves embedded into the filter rod, at least that portion of the wrapper defining each groove being impervious, the grooves being open ended at the mouth end of the filter rod and extending from the mouth end a distance less than the length of the filter rod; a hollow, generally cylindrical mouthpiece coaxially located with said filter rod at the mouth end of the filter rod, the hollow interior of the mouthpiece being open at both ends of the mouthpiece, the circumferential wall of the mouthpiece being formed with a plurality of air flow channels extending generally longitudinally of the mouthpiece from one end to the other end of the mouthpiece, the air flow channels being in flow communication with the open ends of the grooves at the mouth end of the filter rod, the circumferential wall of the mouthpiece being formed with a plurality of filtered smoke flow channels extending generally longitudinally of the mouthpiece from one end to the other end of the mouthpiece, the filtered smoke flow channels being in flow communication with that area of the filter rod mouth end between adjacent grooves of the filter rod, and the hollow interior of the mouthpiece being in flow communication with the smoke flow capillary passageway of the filter rod; and, tipping material extending longitudinally of and circumscribing the filter rod and mouthpiece, the tipping material including means for introducing ventilation air into the grooves of the filter rod, ventilating air being the only fluid flowing through the grooves and through the air flow channels in the mouthpiece when a cigarette having the filter is smoked.

2. A filter according to Claim 1, wherein the hollow interior of the mouthpiece is in flow communication with that portion of the filter rod radially inwardly of the portion of the filter rod in flow communication with the smoke flow passages at the filter rod mouth end.

3. A filter according to Claim 1 or 2, wherein the air flow channels are circumferentially spaced apart

about the circumferential wall of the mouthpiece.

4. A filter according to Claim 1, 2 or 3, wherein the filtered smoke flow channels are circumferentially spaced apart about the circumferential wall of the mouthpiece.

5. A filter according to Claims 3 and 4, wherein the smoke flow channels are located in the spaces adjacent air flow channels.

6. A filter according to any one of the preceding claims, wherein the air flow channels are formed through the circumferential wall of the mouthpiece.

7. A filter according to any one of the preceding claims, wherein the smoke flow channels are formed through the circumferential wall of the mouthpiece.

8. A filter according to any one of Claims 1 to 5, and 7, wherein the air flow channels are formed in the outer peripheral surface of the circumferential mouthpiece wall.

9. A filter according to any one of Claims 1 to 6, and 8, wherein the smoke flow channels are formed in the outer peripheral surface of the circumferential mouthpiece wall.

10. A filter according to any one of the preceding claims, wherein the air flow channels and the smoke flow channels are mutually uniformly spaced apart circumferentially of the mouthpiece wall.

11. A filter according to any one of the preceding claims, wherein the air flow channels and the smoke flow channels are substantially identical in size and shape.

12. A filter according to any one of the preceding claims, wherein the circumferential mouthpiece wall is thicker than the depth of the grooves at the filter rod mouth end.

13. A filter according to any one of the preceding claims, wherein a further wrapper extends about the filter rod and the cylindrical mouthpiece to inter-attach the filter rod and the mouthpiece.

14. A filter as claimed in any one of the preceding claims, wherein the mouthpiece is fabricated of an impermeable material.

15. A cigarette filter substantially as hereinabove described with reference to Figures 1 to 3, and 7, or to Figures 4 to 6, and 7.

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